## Code No.

N - 3589

## Entrance Examination for Admission to the P.G. Courses in the Teaching Departments, 2022

## CSS

## ELECTRONICS (ARTIFICIAL INTELLIGENCE / OPTOELECTRONICS)

## General Instructions



1. The Question Paper is having two Parts - Part ' $A$ ' Objective type (60\%) \& Part ' $B$ ' Descriptive type (40\%).
2. Objective type questions which carry 1 mark each are to be ( $\checkmark$ ) 'tick marked' in the response sheets against the appropriate answers provided.
3. 8 questions are to be answered out of 12 questions carrying 5 marks each in Part ' $B$ '.
4. Negative marking : 0.25 marks will be deducted for each wrong answer in Part 'A'.
Time: 2 Hours
Max. Marks : 100
To be filled in by the Candidate

| Register <br> Number | in Figures |  |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | in words |  |  |  |  |  |  |  |  |

PART - A
(Objective Type)
Choose appropriate answer from the options in the questions. One mark each.
(60 $\times 1$ = 60 marks)

1. An electric field is said to be conservative when
a) The curl of the field is equal to $-\frac{\partial B}{\partial t}$
b) The curl of the field is equal to zero
c) The divergence of the field is equal to zero
d) The Laplacian of the field is equal to $\mu \varepsilon \frac{\partial E}{\partial t}$

2. A charge $Q$ is enclosed by a Guassian spherical surface of radius ' $r$ '. When the radius is doubled, then the outward electric flux will become $\qquad$ .
a) doubled
b) increased four times
c) unchanged
d) reduced to half
3. The Maxwell's equation, $\nabla \times \vec{H}=\vec{j}+\frac{\partial \vec{D}}{\partial t}$ is based on $\qquad$ .
a) Ampere's Law
b) Faraday's Law
c) Gauss's Law
d) Coulomb's Law
4. The magnetic flux through a 100 turns coil, changes at a rate of $0.05 \mathrm{~Wb} / \mathrm{s}$. What is the induced emf between the ends of the coil?
a) 2.5 V
b) 5.0 V
c) 7.5 V
d) 10 V
5. Vector magnetic potential is a vector whose $\qquad$ .
a) curl is equal to the magnetic flux density
b) curl is equal to the electric field intensity
c) divergence is equal to the electric potential
d) none of these
6. The polarization of a wave with electric field vector

$$
\vec{E}=E_{0} e^{j(\omega t-\beta z)}\left(\vec{a}_{x}+\vec{a}_{y}\right) \text { is }
$$

$\qquad$ .
a) Left Circular
b) Right Circular
c) Elliptical
d) Linear
7. A generator of internal impedance $Z_{g}$ delivers maximum power to a load impedance $Z_{L}$, when
a) $Z_{L}=0$
b) $\quad Z_{\llcorner }=2 Z_{g}$
c) $\quad Z_{L}=Z_{g}$
d) $Z_{L}=1.5 Z_{g}$
8. A series RLC circuit with $R=20 \Omega, L=1 \mathrm{mH}$ and $C=0.1 \mu \mathrm{~F}$ is supplied by 220 V . The Q -factor of the inductor at resonance is $\qquad$ .
a) 25
b) 20
c) 10
d) 5
9. Maximum value of power factor is $\qquad$ .
a) zero
b) infinity
c) 1
d) 0.95
10. In Maxwell's L/C bridge, the frequency $\omega$ is $\qquad$ in balanced condition.
a) directly proportional to inductance
b) inversely proportional to capacitance
c) directly proportional to capacitance
d) independent of capacitance and inductance
11. Potential to which the conductor of a capacitor raised depends on
a) The geometry of the conductor
b) Charge on conductor
c) Both a) and b)
d) None of the above
12. $\qquad$ is a measure of the opposition to the flow of an alternating current in a circuit?
a) Resistance
b) Capacitance
c) Admittance
d) Impedance
13. The ripple frequency of the half wave-rectifier is around $\qquad$ .
a) 50 Hz
b) 100 Hz
c) 200 Hz
d) None of the above
14. In a transistor, $I C=100 \mathrm{~mA}$ and $I E=100.5 \mathrm{~mA}$. The value of $\beta$ is $\qquad$ .
a) 0.5
b) 200
c) 0.995
d) 1.005
15. An amplifier with a gain of 30 dB is fed with a $1 \mu \mathrm{~W}$ power. The output power of the amplifier is
a) 1.0 W
b) 30 dBm
c) -30 dBm
d) 0 dBm
16. An FM radio receiver is tuned to a 91.9 MHz radio station; it will receive an image frequency of
a) 102.3 MHz
b) 113.3 MHz
c) 70.5 MHz
d) 80.9 MHz
17. MOSFET can be used as a
a) Voltage controlled capacitor
b) Current controlled capacitor
c) Current controlled inductor
d) None of the above
18. Class $A B$ operation is used in large signal power amplifiers in order to
a) Get maximum efficiency
b) Remove even harmonics
c) Reducing collector dissipation
d) Overcome cross over distortion
19. The characteristic of an ideal opamp
a) Zero input impedance, infinite output impedance and infinite gain
b) Infinite input impedance, zero output impedance and infinite gain
c) Zero input impedance, zero output impedance and infinite gain
d) Infinite input impedance, infinite output impedance and infinite gain
20. Output voltage, $\mathrm{V}_{\mathrm{O}}$ of the circuit shown below is

a) 1.5 V
b) 2.5 V
c) -2.5 V
d) -4.5 V
21. The amplifier used to strengthen the output of a transducer
a) Peaking amplifier
b) Bridge amplifier
c) Instrumentation amplifier
d) Differential amplifier
22. A differential amplifier has a common-mode gain of 0.2 and a common-mode rejection ratio of 3250 . What would the output voltage be if the single-ended input voltage was 7 mV rms?
a) 1.4 V rms
b) 650 mV rms
c) 4.55 V rms
d) 0.455 V rms
23. Band reject filter to reject frequencies between $f_{1}$ and $f_{2}\left(f_{2}>f_{1}\right)$ can be constructed by $\qquad$ .
a) Connecting LPF of $f_{c}=f_{1}$ in series with HPF of $f_{c}=f_{2}$
b) Connecting LPF of $f_{c}=f_{2}$ in series with HPF of $f_{c}=f_{1}$
c) Connecting LPF of $f_{c}=f_{1}$ and HPF of $f_{c}=f_{2}$ in parallel
d) Connecting inputs of both LPF of $f_{c}=f_{1}$ and HPF of $f_{c}=f_{2}$ and then summing their outputs
24. Barkheusen criterion for oscillation is
a) Loop gain should be unity and phase of the feedback signal with respect to input signal is zero degree
b) Loop gain should be less than unity and phase of the feedback signal with respect to input signal is 360 degree
c) Loop gain should be unity and phase of the feedback signal with respect to input signal is 180 degree
d) Loop gain should be less than unity and phase of the feedback signal with respect to input signal is 180 degree
25. At which state the phase-locked loop tracks any change in input frequency?
a) Free running state
b) Capture state
c) Phase locked state
d) All of the above
26. Hysteresis is desirable in Schmitt Trigger because
a) Energy is to be stored and discharged in parasitic capacitances
b) Effects of temperature to be compensated
c) Devices in the circuit should be given time for saturation and de-saturation
d) None of the above
27. For long distance communication $\qquad$ fiber is preferred
a) Graded index multimode
b) Step index single mode
c) Step index multimode
d) None of these
28. The technique by which image is obtained from a hologram is called
$\qquad$ .
a) Reconstruction
b) Construction
c) Formation
d) Projection
29. In semiconductor laser diodes, population inversion is achieved by
$\qquad$ _.
a) Lightly doped $p$ and $n$ sides
b) Heavily doped $p$ and $n$ sides
c) Introducing trap centres on $p$ and $n$ sides
d) Reverse biasing the junction
30. Which law is applied for achieving the relation between Einstein's Coefficients?
a) Planck's radiation law
b) Einstein's equation
c) Heisenberg's uncertainty principle
d) Quantum law
31. The lifetime of a meta-stable state in a Ruby laser is $\qquad$ .
a) $10^{-4} \mathrm{~s}$
b) $10^{-3} \mathrm{~s}$
c) $10^{-2} \mathrm{~s}$
d) $\quad 10^{-1} \mathrm{~s}$
32. In an optical fiber, the concept of Numerical aperture is applicable in describing the ability of $\qquad$ .
a) Light scattering
b) Light polarization
c) Light dispersion
d) Light collection
33. The cause of attenuation in optical fiber is $\qquad$ .
a) Scattering
b) Absorption
c) Both a) and b)
d) None of these
34. The device that distributes light from a main fiber to one or more branch fibres is called $\qquad$ .
a) Optic fiber splice
b) Optic fiber connector
c) Optic fiber isolator
d) Optic fiber coupler
35. The Miller index of the plane which intersects the coordinate axes at $x=\frac{2}{3}$, $y=\frac{1}{3}$ and $z=\frac{1}{2}$ is
a) $9,3,2$
b) 4, 2, 3
c) $3,6,4$
d) $4,3,3$
36. In the X-ray diffraction of a set of crystal planes having a path difference of 0.2 nm , first order reflection is found to be at an angle of $21^{\circ}$. The wavelength of X-ray is $\left(\sin 21^{\circ}=0.358\right)$
a) 0.143 nm
b) 0.134 nm
c) 0.221 nm
d) 0.312 nm
37. The concentration of minority carrier in an extrinsic semiconductor under equilibrium is $\qquad$ .
a) Directly proportional to the doping concentration
b) Inversely proportional to the doping concentration
c) Directly proportional to the intrinsic concentration
d) Inversely proportional to the intrinsic concentrations
38. Hall voltage is $\qquad$ when the semiconductor is extrinsic.
a) Zero
b) 1 V
c) -1 V
d) None of these
39. Which of the following metals will exhibit a photoelectric effect mostly?
a) Sodium
b) Magnesium
c) Lithium
d) Caesium
40. Which of the following is an invalid BCD number?
a) 1001
b) 1101
c) 1000
d) None of the above
41. AND gate will function as an OR gate if
a) All the inputs are zero
b) All the inputs are one
c) All the inputs and outputs are complemented
d) Alternate inputs are one and zero
42. Binary code of $(27.125)_{10}$ is
a) 11100.110
b) 11011.101
c) 11101.110
d) 11011.001
43. The logic circuits whose outputs at any instant of time depends not only on the present input but also on the past outputs are called $\qquad$ .
a) Sequential circuits
b) Combinational circuits
c) Flip flops
d) Latches
44. Which of the following statements are not correct about the main memory of a computer?
a) In main memory, data gets lost when power is switched off.
b) Main memory is faster than secondary memory but slower than registers.
c) They are made up of semiconductors.
d) Main memory is cheaper compared to secondary memory.
45. What is the output of the following program?

```
int main( )
{
int a=10, b=20;
a = a+b;
b = a-b;
a = a-b;
printf("a=%d b=%d",a,b);
```

return 0 ;
\}
a) $a=20, b=20$
b) $a=10, b=20$
c) $a=20, b=10$
d) $a=10, b=10$
46. Numerical techniques more commonly involve $\qquad$ .
a) Elimination method
b) Reduction method
c) Iterative method
d) Direct method
47. A multiplexer is placed between a group of 32 registers and an accumulator to regulate data movement such that at any given point of time the content of only one register will move to the accumulator. The minimum number of select lines needed for the multiplexer is
a) 32
b) 5
c) 31
d) 6
48. The initial content of the 4 bit serial in parallel out shift register shown below is 1100. After four clock pulses are applied, the content of the shift register will be

a) 1110
b) 1100
c) 1101
d) 1111
49. What does the statement, $X-=y+1$ means
a) $x=x-y+1$
b) $x=x-y-1$
c) $x=x+y+1$
d) $x=x+y-1$
50. Which signal is used to insert wait states in 8085 microprocessor?
a) HOLD
b) INTR
c) RESET
d) READY
51. The number of machine cycle corresponding to the instruction LDA 16 bit address is
a) 1
b) 2
c) 3
d) 4
52. The stack pointer of 8085 microprocessor is 74FD. After executing the sequence of instructions, the content of stack pointer is

PUSH B
XTHL
PUSHD
JMP 8100
a) 7511
b) 74 F 9
c) 74 F 7
d) 7510
53. In mode 2 of I/O mode of 8255 , which of the following ports are capable of transferring the data in both the directions?
a) PORT A
b) PORT B
c) PORT C
d) All of the above
54. Which of the following addressing method does the instruction, MOV $A X,[B X]$ represent?
a) Register indirect addressing mode
b) Direct addressing mode
c) Register addressing mode
d) Register relative addressing mode
55. Evaluate $\int e^{x} \cos x d x$
a) $\frac{1}{2} e^{x}[\sin x+\cos x]+C$
b) $\frac{1}{2}[\sin x+\cos x]+C$
c) $\frac{1}{2} e^{x}[\cos x]+C$
d) None of these
56. For the vector $\vec{F}=6 y z \hat{i}+2 x z \hat{j}+3 x y \hat{k}$, the value of $\nabla \cdot(\nabla \times \vec{F})$ is
a) 1
b) 11
c) 5
d) 0
57. The differential equation $\frac{d y}{d x}+P y=Q$ is a linear equation of first order only if
a) $\quad P$ is a constant but $Q$ is a function of $y$
b) $\quad P$ and $Q$ are functions of $y$ or constants
c) $\quad P$ and $Q$ are functions of $x$ or constants
d) $\quad P$ is a function of $y$ and $Q$ is a constant
58. Consider a function $u$ which depends position $x$ and time $t$, the partial differential equation $\frac{\partial u}{\partial t}=\frac{\partial^{2} u}{\partial x^{2}}$ is known as
a) Wave equation
b) Laplace's equation
c) Heat equation
d) Elasticity equation
59. A set of linear equations is represented by the matrix equation $A x=B$. The necessary condition for the existence of a solution for this system is
a) A must be invertible
b) $B$ must be linearly independent on the columns of $A$
c) $B$ must be linearly independent on the rows of $A$
d) None of these
60. Let $f(x)$ be a real, periodic function which satisfies the condition $f(-x)=-f(x)$. The general form of its Fourier series representation would be $\qquad$ .
a) $f(x)=a_{0}+\sum_{k=1}^{\infty} a_{k} \cos (k x)$
b) $f(x)=a_{0}+\sum_{k=1}^{\infty} a_{k} \sin (k x)$
c) $f(x)=a_{0}+\sum_{k=1}^{\infty} a_{k} \cos (k x)+\sum_{k=1}^{\infty} a_{k} \sin (k x)$
d) $f(x)=\sum_{k=1}^{\infty} a_{k} \cos (k x)+\sum_{k=1}^{\infty} a_{k} \sin (k x)$

## ANSWER SHEET — PART - A

| 1 | A | B | C | D | E | 21 | A | B | C | D | E |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | A | B | C | D | E | 22 | A | B | C | D | E |
| 3 | A | B | C | D | E | 23 | A | B | C | D | E |
| 4 | A | B | C | D | E | 24 | A | B | C | D | E |
| 5 | A | B | C | D | E | 25 | A | B | C | D | E |
| 6 | A | B | C | D | E | 26 | A | B | C | D | E |
| 7 | A | B | C | D | E | 27 | A | B | C | D | E |
| 8 | A | B | C | D | E | 28 | A | B | C | D | E |
| 9 | A | B | C | D | E | 29 | A | B | C | D | E |
| 10 | A | B | C | D | E | 30 | A | B | C | D | E |
| 11 | A | B | C | D | E | 31 | A | B | C | D | E |
| 12 | A | B | C | D | E | 32 | A | B | C | D | E |
| 13 | A | B | C | D | E | 33 | A | B | C | D | E |
| 14 | A | B | C | D | E | 34 | A | B | C | D | E |
| 15 | A | B | C | D | E | 35 | A | B | C | D | E |
| 16 | A | B | C | D | E | 36 | A | B | C | D | E |
| 17 | A | B | C | D | E | 37 | A | B | C | D | E |
| 18 | A | B | C | D | E | 38 | A | B | C | D | E |
| 19 | A | B | C | D | E | 39 | A | B | C | D | E |
| 20 | A | B | C | D | E | 40 | A | B | C | D | E |

# ELECTRONICS SPECIALIZATION IN OPTOELECTRONICS / ARTIFICIAL INTELLIGENCE 

PART - B<br>(Descriptive Type)

Answer any eight questions. Each question carries 5 marks. ( $8 \times 5=\mathbf{4 0}$ Marks)

1. Derive the boundary conditions for a dielectric-dielectric interface.
2. State and prove the Poynting Theorem.
3. With neat diagrams explain the working of a bridge rectifier.
4. An AM wave is represented by the expression :
$v=5(1+0.6 \cos 6280 t) \sin 211 \times 10^{4} t$ volts
(i) What are the minimum and maximum amplitudes of the AM wave?
(ii) What frequency components are contained in the modulated wave and what is the amplitude of each component?
5. Draw the circuit of a Schmitt trigger circuit using op-amp and explain its working.
6. Explain the different classification of optic fibers in detail.
7. Explain the working of EDFA with a neat schematic diagram.
8. Explain the energy band theory of crystals.
9. Explain the dielectric properties of materials.
10. Explain the working of a ring counter using shift register.
11. Write an 8085 Assembly language program to find the largest number from a set of numbers.
12. Determine $A^{4}$ using Cayley-Hamilton Theorem.

$$
A=\left[\begin{array}{cccc}
1 & 0 & 0 & 1 \\
0 & -1 & 0 & -1 \\
0 & 0 & i & i \\
0 & 0 & 0 & -i
\end{array}\right] .
$$

